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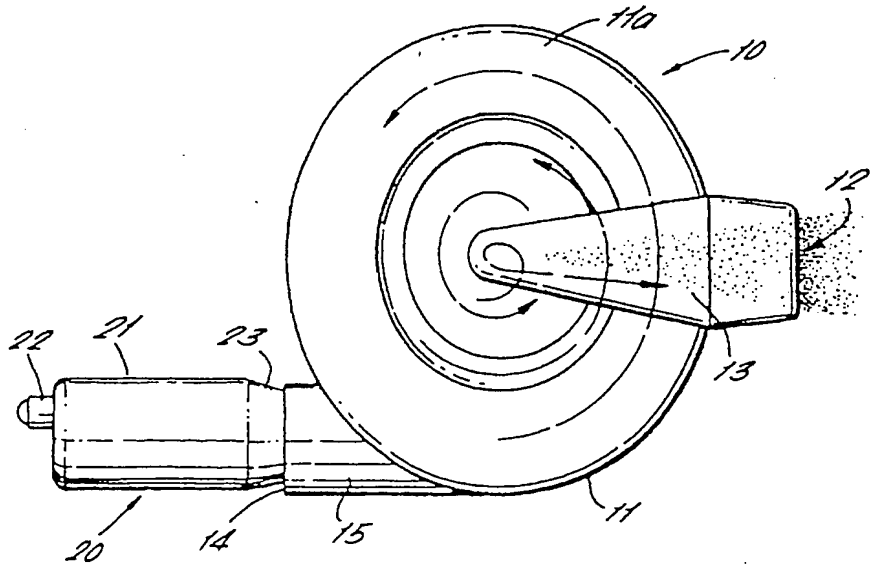
(54) Abstract Title
Apparatus for dispensing substances for inhalation

(57) Inhalation apparatus (1) comprises a housing (11) defining a socket (37) for receiving a pressurised dispensing container (30). Actuator means (61; 80) are provided for receiving a valve stem (63) of the dispensing container and a cylindrical chamber (11a) having an inlet (67) and an outlet (16). The actuator means defines duct means to direct product dispensed from the valve stem of the dispensing container through the inlet of the cylindrical chamber in a direction substantially tangential to the major axis of the chamber. The outlet of the chamber communicates with the mouthpiece (12), the inlet being located at a periphery of the chamber and the outlet being located at or near a centre of the chamber such that inhalation by a user creates a cyclonic airflow in the chamber between the inlet and outlet from which the dispensed product is entrained for inhalation.

FIG. 2.



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At least one drawing originally filed was informal and the print reproduced here is taken from a later filed formal copy.

FIG. 1.

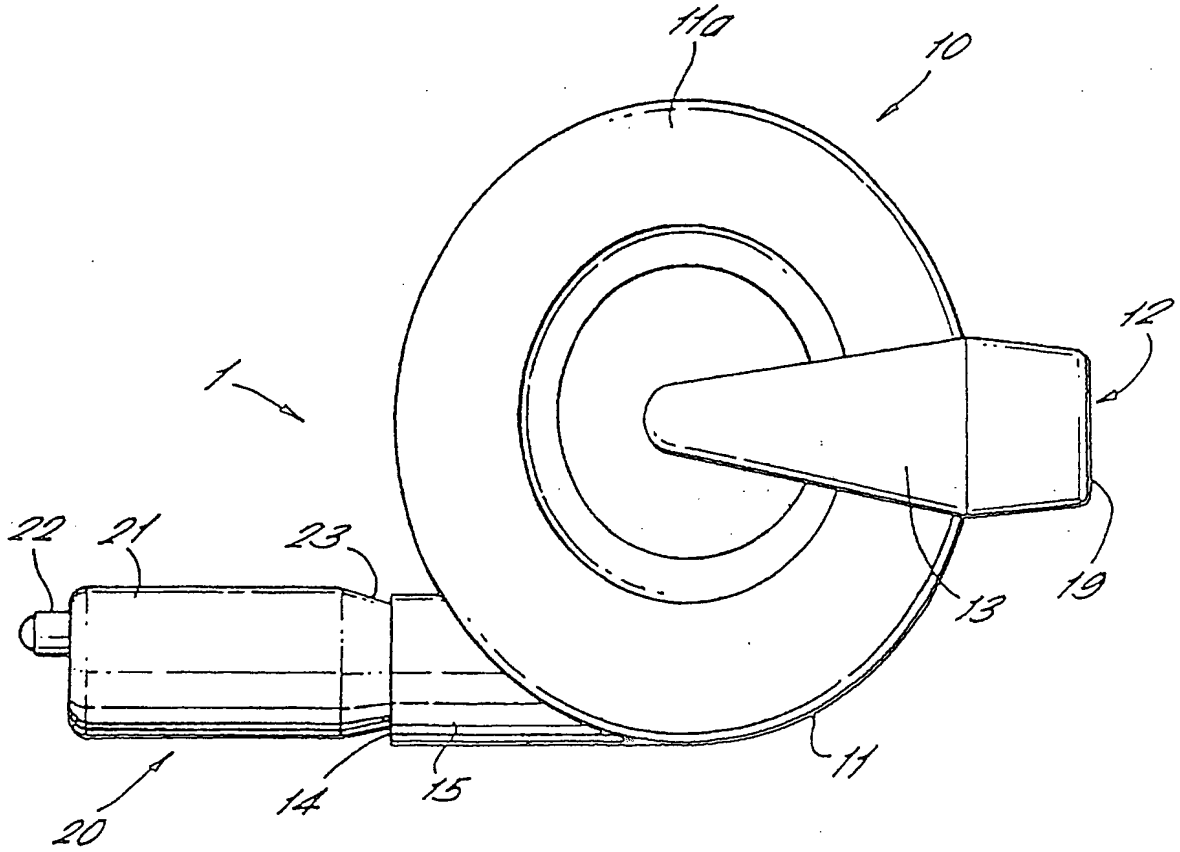


FIG. 2.

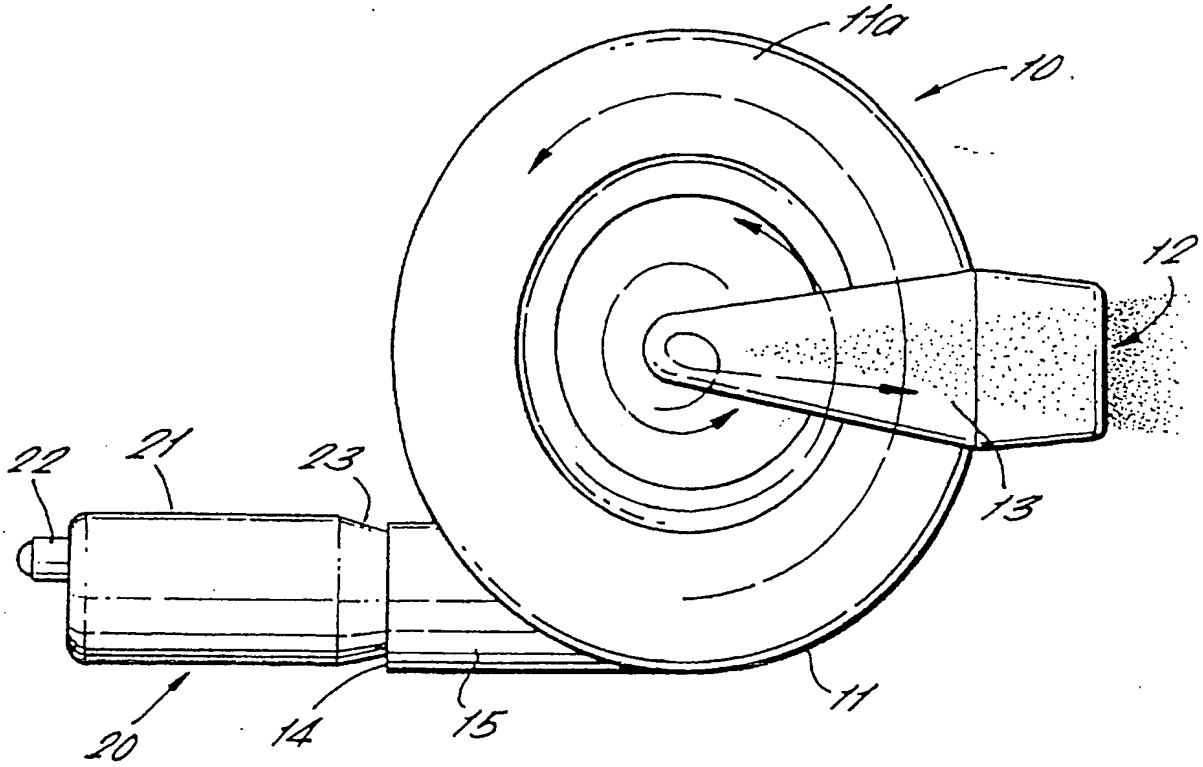


FIG. 4.

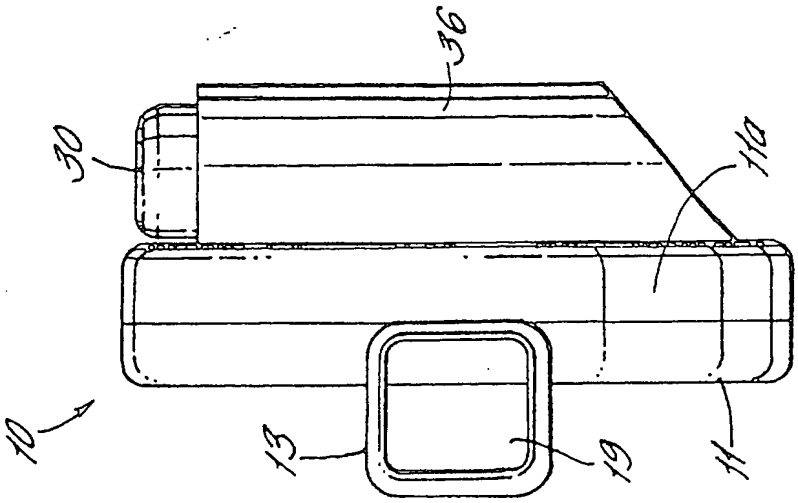
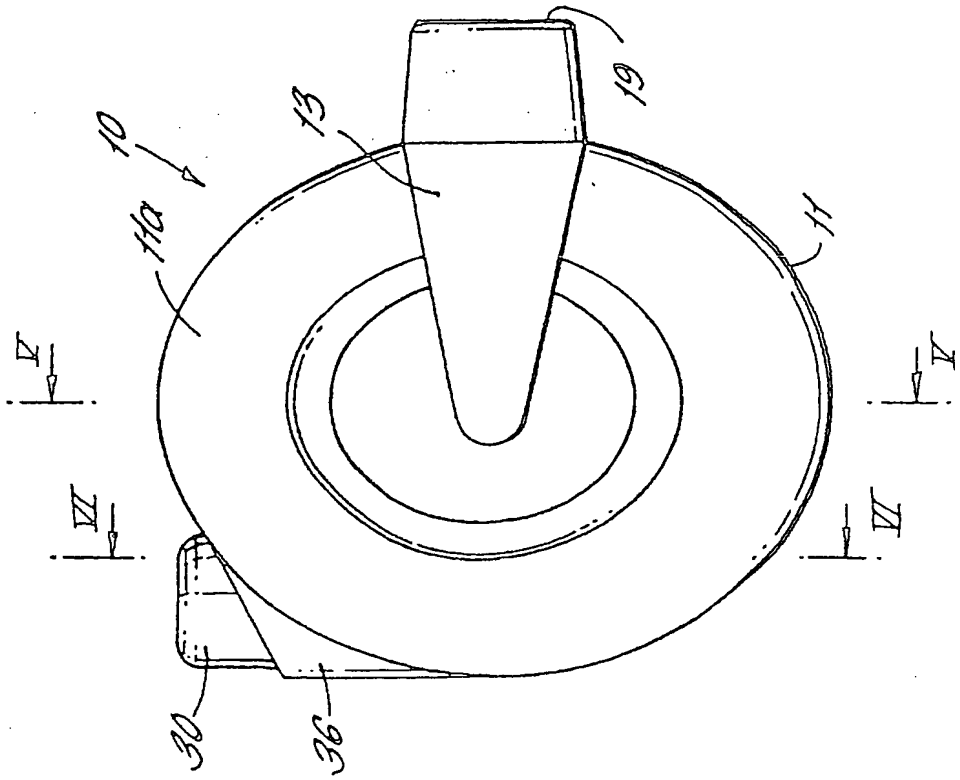


FIG. 3.



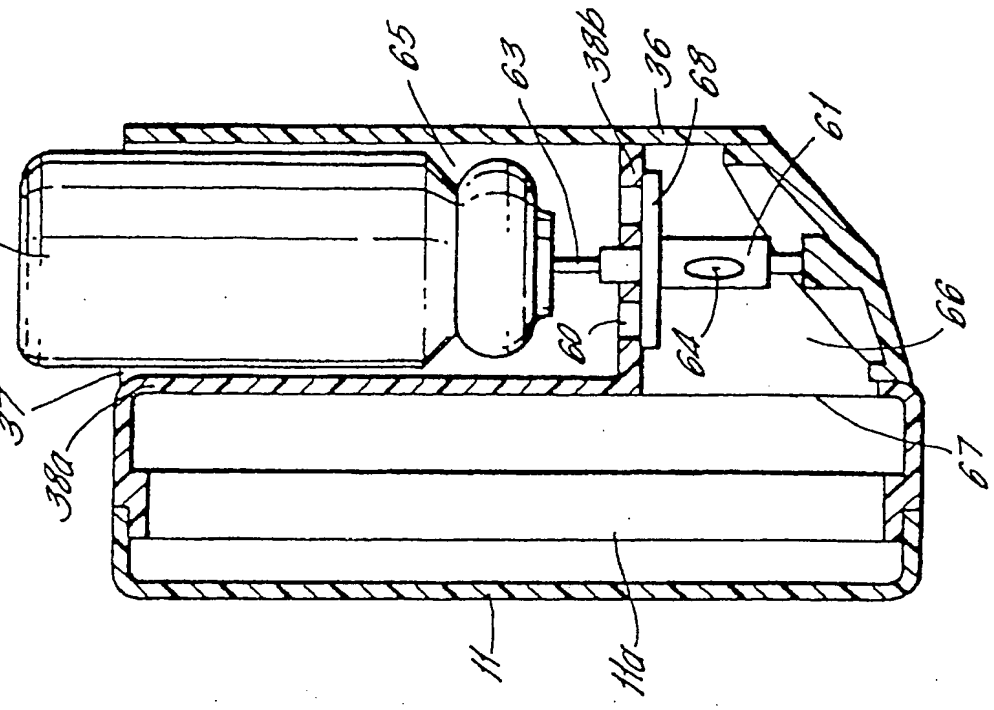


FIG. 6.

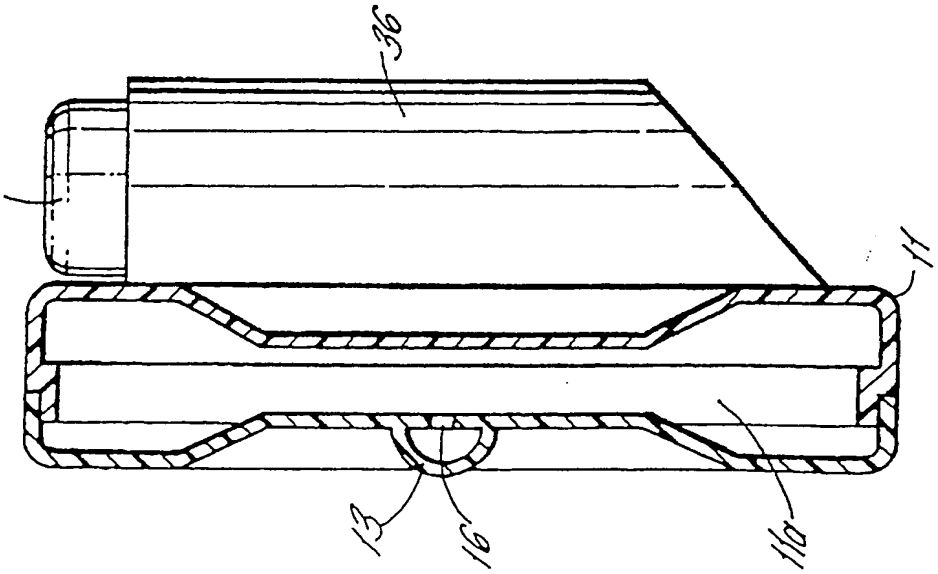


FIG. 5.

FIG. 8.

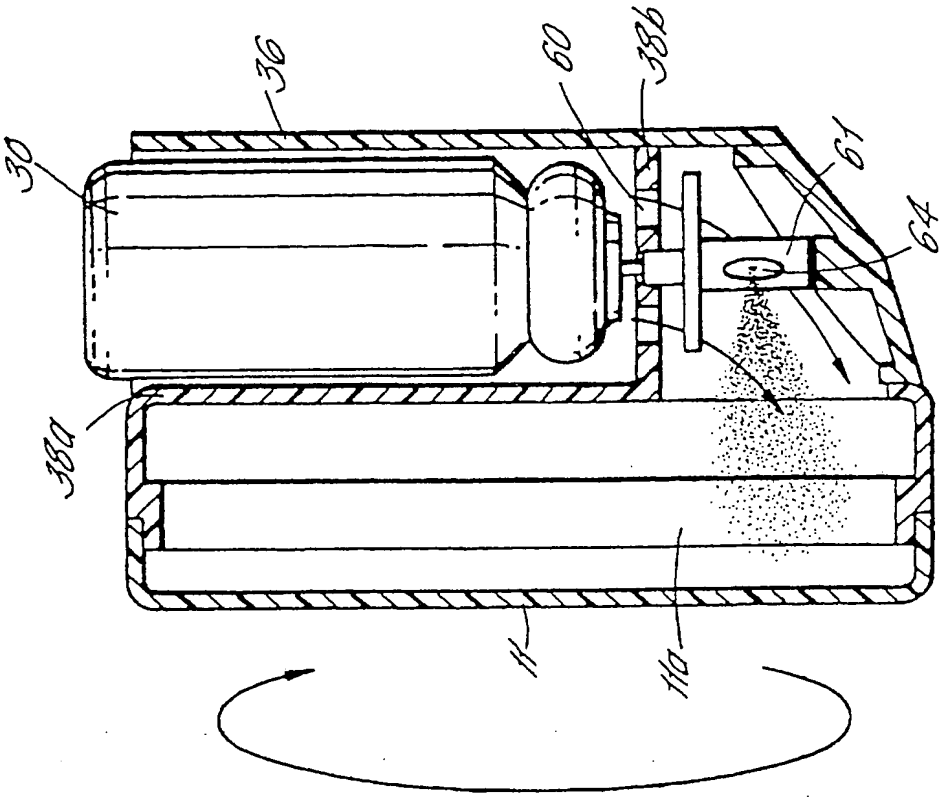


FIG. 7.

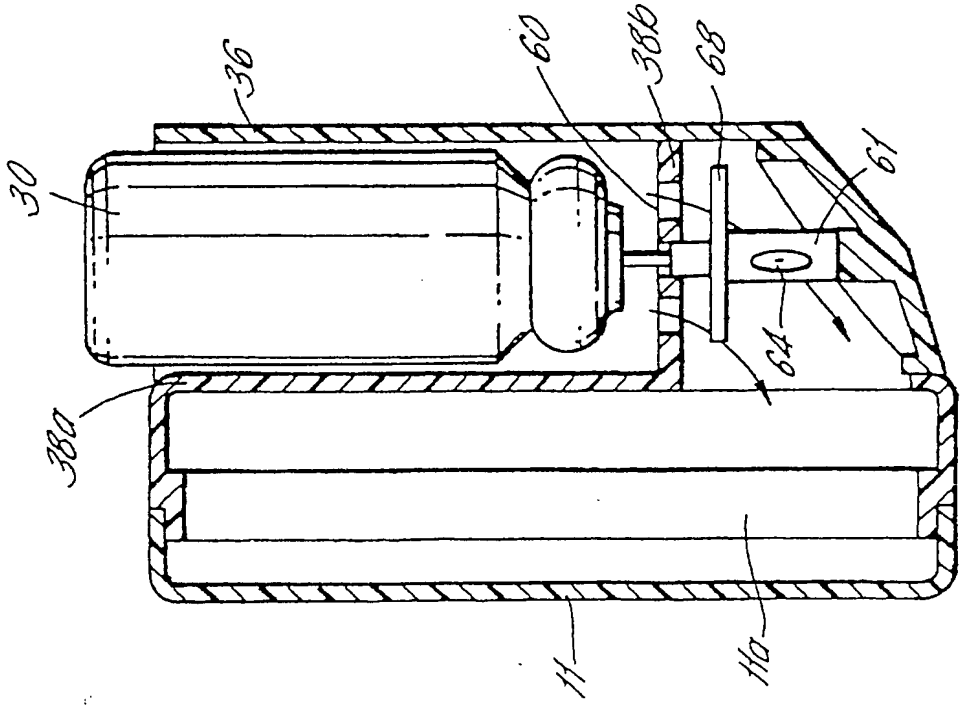


FIG. 9.

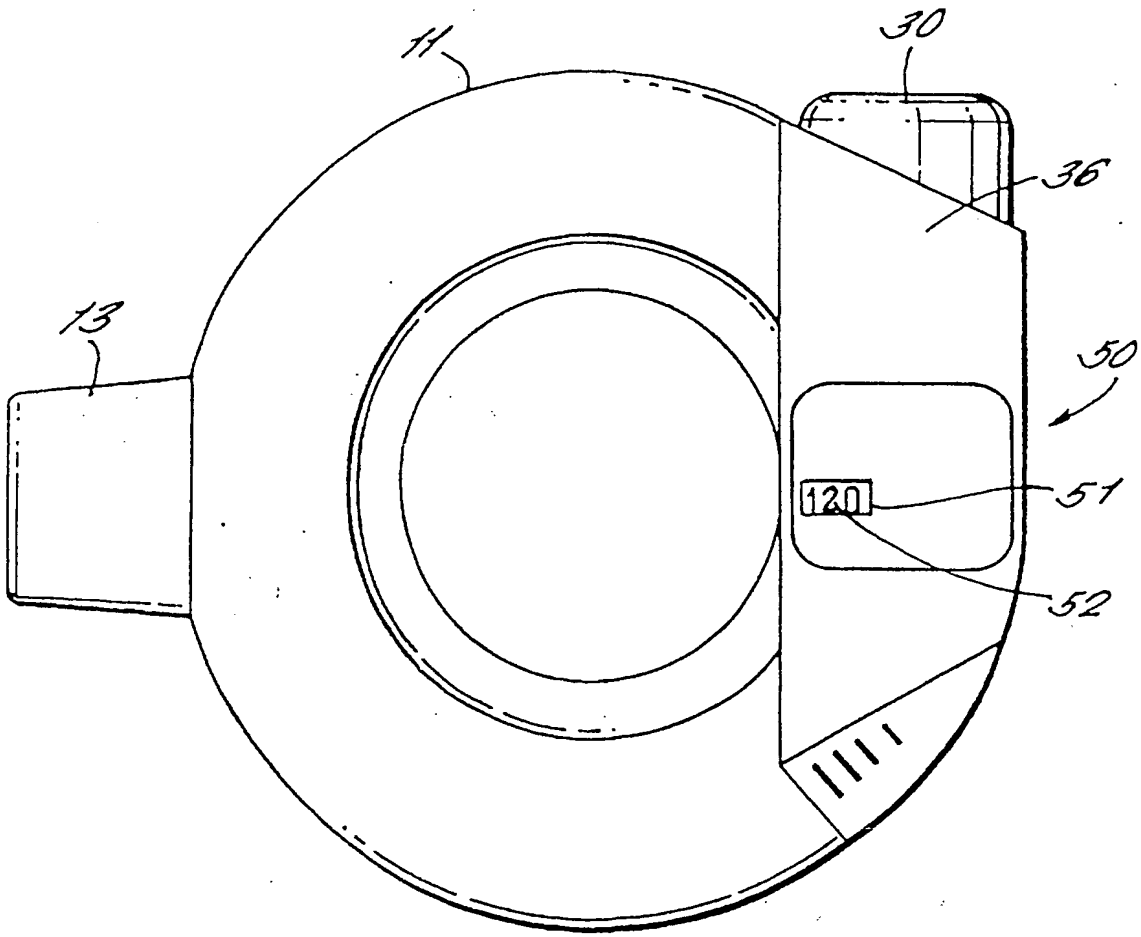


FIG. 10.

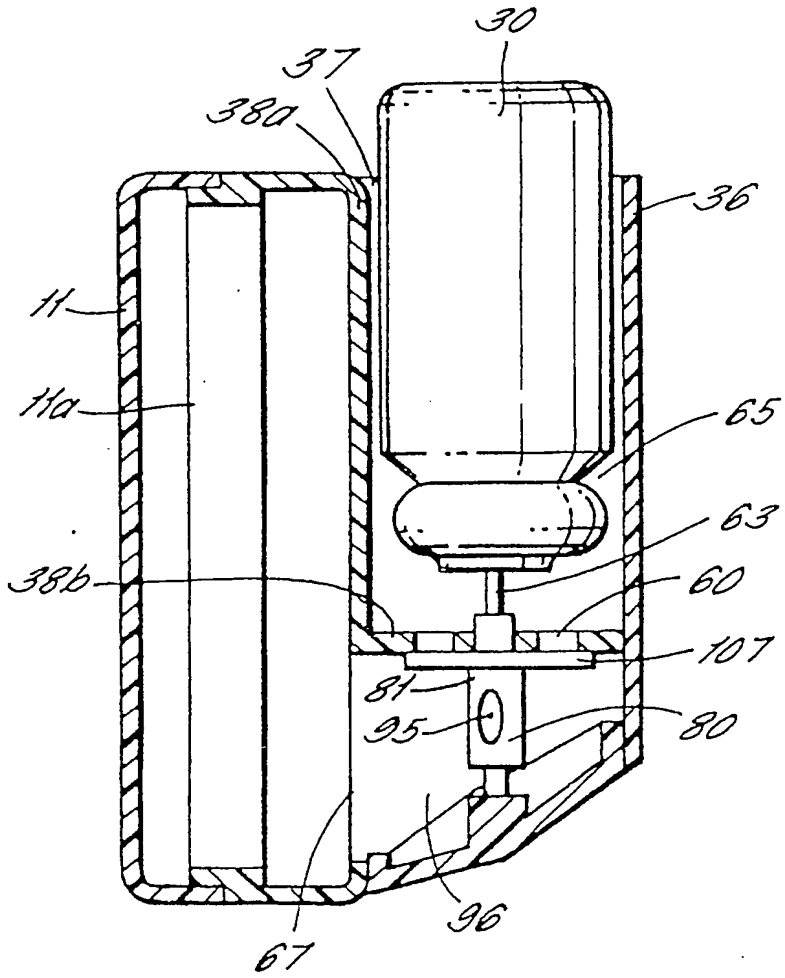
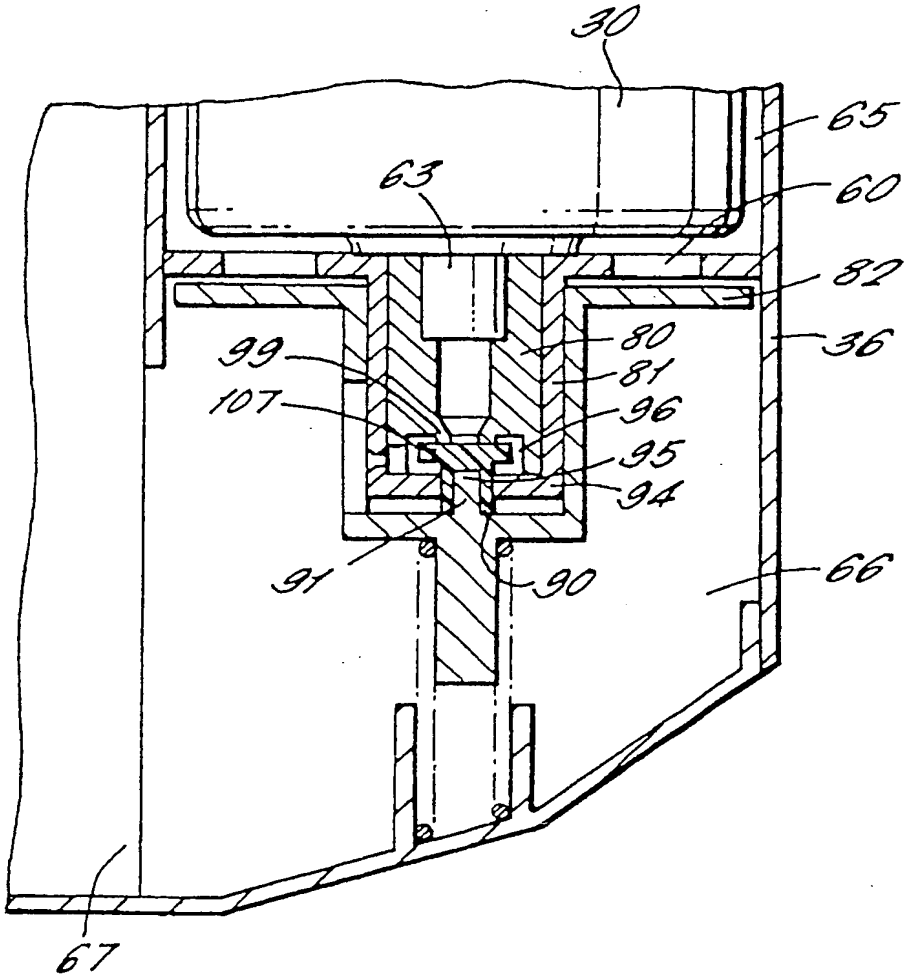


FIG. 11.



IMPROVEMENTS IN OR RELATING TO DISPENSING APPARATUS

This invention relates to an inhalation apparatus for dispensing substances for inhalation and, in particular, but not exclusively, for dispensing medicinal products.

Known dispensing apparatus for use in inhalation apparatus include metered dose inhalers and dry powder inhalers. In known metered dose inhalers, the aerosol stream from a pressurised dispensing container is fired towards a patient or user of the inhaler into an airflow travelling in the same direction. A user inhales through a mouthpiece of the inhaler and creates an airflow through the container from air inlet holes which are generally at a part of the inhaler well spaced from the mouthpiece. Medicament is then released into this airflow at a point between the air inlet holes and the mouthpiece so that it is travelling in the same direction as the airflow. Typically, in such devices, there is no restriction in the airflow between the air inlet holes and the mouthpiece. Because of this, a substantial airflow can be created by the user of the device and, because the medicament is fired into the airflow in the same direction as the airflow, the effect is that particles of medicament can attain quite substantial velocities. As inhalers of this type are normally designed to be as small as practical for the convenience of the user, the distance between the point at which the medicament is fired and the patient's mouth is usually quite small so that there is little distance for the inertia of the particles of medicament to decrease with the result that the particles may impact in the oro-pharynx of a user with quite high velocity. This can

be a problem with certain medicaments.

In known dry powder inhalers, powdered medicament, which is often combined with a powdered carrier, such as lactose, is stored within a delivery device until delivery of the medicament is required. It is known to store the medicament in a bulk holding reservoir in the delivery device. The drug is removed from the reservoir on an as required basis. It is also known to provide dry powder inhalers wherein the medicament is contained within discreet doses within a dosage unit such as a gelatine capsule. A problem with both types of known dry powder inhaler is that the medicament and carrier can form relatively large particles which when inhaled by the user do not reach deep into the lungs, which has been shown to be necessary for the most advantageous medical result to be obtained. It is known to provide baffle plates within an airflow passageway of a dry powder inhaler such that the medicament and carrier impact on the baffle plates and are, to a degree, separated and the particle size reduced. However, a problem with such baffle plates is that the medicament and carrier only pass through the baffle plates once and, as a result, a significant proportion of larger particles still exit the inhaler and are inhaled by the user.

According to the present invention there is provided inhalation apparatus comprising a housing, defining therein a chamber having a major axis; an inlet communicating with the chamber and with a dispensing unit; and a mouthpiece communicating with the chamber through an aperture at or near the major axis; wherein when a user of the apparatus inhales through the mouthpiece an airflow is created from the inlet through the chamber to the mouthpiece such that product dispensed from the dispensing unit is directed

into the chamber in a direction having a component tangential to the major axis such that the airflow in the chamber is directed in an inwardly rotational direction from the inlet to the aperture.

The present invention also provides a method of inhaling product comprising providing a housing defining therein a chamber having an inlet communicating with the chamber and with a dispensing unit, and a mouthpiece communicating with the chamber through an aperture at or near a centre of the chamber; dispensing product from the dispensing unit; and inhaling on the mouthpiece to create an airflow from an exterior of the housing through the dispensing unit and chamber to the mouthpiece to entrain the product therein; wherein the airflow in the chamber is directed in an inwardly rotational direction from the inlet to the aperture.

Preferred embodiments of the present invention will now be described, by way of example only, with reference to the accompanying drawings, in which:

Figure 1 is a side elevation of a first embodiment of dispensing apparatus according to the present invention;

Figure 2 is a schematic side elevation of the apparatus of Figure 1 in use;

Figure 3 is a side elevation of a second embodiment of dispensing apparatus according to the present invention;

Figure 4 is a front elevation of the apparatus of Figure 3;

Figure 5 is a cross-sectional elevation taken on line V-V of Figure 3;

Figure 6 is a schematic cross-section taken on line VI-VI of Figure 3;

Figure 7 shows the apparatus of Figure 6 immediately prior to dispensing of medicament;

Figure 8 shows the apparatus of Figure 6 during dispensation of medicament;

Figure 9 shows a side elevation of a third embodiment of dispensing apparatus according to the present invention;

Figure 10 shows a cross-sectional schematic elevation of a fourth embodiment of dispensing apparatus according to the present invention; and

Figure 11 shows an enlarged cross-sectional schematic elevation of part of the apparatus of Figure 10.

The dispensing apparatus 1 of the present invention as shown in Figures 1 to 11 comprises a spacer unit generally denoted by reference 10 which is either permanently or releasably connected in use to a dispensing unit generally designated by reference numeral 20.

In the first embodiment as shown in Figures 1 and 2 the dispensing unit 20 comprises a dry powder inhaler. The dry powder inhaler may be of any known type. Typically, the dry powder inhaler comprises a housing 21 defining an airflow passageway from an inlet open to atmosphere to an outlet 23. Dosage units 22 containing the product to be dispensed are inserted in the housing 21. Means are provided for selectively opening the dosage units such that the powdered product is displaced, sucked or blown into the airflow passageway where it is entrained in the airflow created through the housing 21 on inhalation of the user. Triggering means are provided for operating the inhaler.

The spacer unit 10 of the first embodiment

comprises a generally cylindrical housing 11 defining a spacer chamber 11a. The spacer chamber 11a has a major axis X, as shown for example in Figure 4, aligned with a centre 18 of housing 11. A hollow inlet duct 15 extends approximately tangentially from the housing 11 terminating in an inlet 14. The inlet 14 is shaped to conform to the outlet 23 of the dry powder inhaler 20 in an air-tight manner such that airflow exiting the outlet 23 enters the inlet 14 without any leakage.

A hollow mouthpiece duct 13 extends radially outwardly from the centre 18 of the housing 11 terminating in a substantially tubular mouthpiece 12 which extends beyond the periphery 17 of the housing 11. The mouthpiece 12 defines an outlet 19. The spacer chamber 11a communicates with the mouthpiece duct 13 through an aperture 16 in one side of the housing 11 positioned at or near the centre 18 as best shown in Figure 5.

Doughnut shaped chamber

Preferably the width of the chamber 11a, as measured in the direction of the major axis X, decreases from the periphery of the chamber 11a to the centre 18.

The housing 11, inlet duct 15 and mouthpiece duct 13 may all be moulded from suitable plastics materials and are preferably moulded as a single unit. In addition the dry powder inhaler housing 21 may be integrally moulded with the spacer unit moulding.

In use, a user of the apparatus 1 operates the triggering means of the dry powder inhaler to dispense a dosage of powdered product. The user then places their mouth over mouthpiece 12 and inhales to create an airflow from an exterior of the apparatus 1, through the dry powder inhaler 20, outlet 23, inlet duct 15 and spacer chamber 11a. The airflow entering

the spacer chamber 11a enters in a direction having a substantial tangential component relative to the major axis X such that the airflow is constrained to move in a rotational manner around the spacer chamber 11a due to the cylindrical shape of housing 11. As the user inhales air is drawn towards the centre 18 of the spacer chamber 11a and out through aperture 16, along mouthpiece duct 13 and exits outlet 19 where it is inhaled by the user. Thus, inhalation by the user creates a cyclonic, rotating air flow within spacer chamber 11a. The product is entrained in the air flow and passes with the air into spacer chamber 11a. Due to the cyclonic nature of the air flow within spacer chamber 11a, larger particles of product are held in the peripheral region 17 of the spacer chamber 11 whilst smaller particles are drawn towards the centre 18 of the spacer chamber 11a where they exit the chamber 11a through aperture 16 into mouthpiece duct 13 and mouthpiece 12 where they are inhaled. Thus, the cyclonic air flow in chamber 11a acts on the medicament as a classifier separating relatively small particles from relatively large particles and only passing relatively small particles through aperture 16 for inhalation.

It will be noted that the spacer unit 20 is suitable for attachment to any dry powder inhaler. In particular, inlet duct 15 and inlet 14 may be adjusted to provide an airtight fit with different sizes and configurations of dry powder inhaler.

Figures 3 to 8 show a second embodiment of dispensing apparatus according to the present invention in which the dispensing unit 30 comprises a pressurised dispensing container 30 of the type consisting of a pressurised container, metering valve attached thereto having a valve stem 63 extending

axially to protrude from the metering valve. The pressurised dispensing container 30 typically contains medicament either in solution or suspension and a propellant system.

As in the first embodiment the spacer unit 20 comprises a cylindrical housing 11, spacer chamber 11a and mouthpiece duct 13. A generally cylindrical housing 36 is integrally formed on one side of housing 11. As shown in Figure 6, the cylindrical housing 36 is divided into upper and lower sections 65 and 66 by an annular partition 38b. Airflow holes 60 are provided in the partition to allow air to pass from the upper to lower section. The upper section 65 of the cylindrical housing 36 defines a socket 37, in which in use the pressurised dispensing container 30 is inserted, and is separated from spacer chamber 11a by a partition 38a. The pressurised dispensing container 30 fits loosely in the upper section 65 of the cylindrical housing 36 such that air may readily pass between the pressurised dispensing container 30 and the walls of the cylindrical housing.

The lower section 66 of cylindrical housing 36 communicates with the spacer chamber 11a through an aperture 67 which opens into the chamber 11a tangentially.

The lower section 66 of the cylindrical housing 36 contains an actuator 61. The actuator 61 has a cylindrical body, in an upper end of which is a bore for receiving a valve stem of the pressurised dispensing container 30 when the pressurised dispensing container 30 is inserted in socket 37 with the valve stem 63 lowermost. The valve stem receiving bore communicates via a duct with an opening 64 in the side wall of the actuator body which is arranged to direct an aerosol through 90° on discharge in a

direction towards the aperture 67 connecting the lower section 66 with the spacer chamber 11a. The actuator 61 also comprises a radially extending flange 68 of a large enough diameter to sealingly cover and close the airflow holes 60. A helical compression spring is provided between a lower end of the actuator 61 and a base of the cylindrical housing to bias the actuator 61 upwardly such that, in the rest position, the annular flange 68 contacts the partition 38b and seals the airflow holes 60.

In use, the user inserts the mouthpiece 12 of the spacer unit 10 into their mouth and inhales. Initially, as the airflow holes 60 are sealed by the flange 68, there is no airflow. Whilst continuing to inhale, the user manually depresses the dispensing container 30 causing the valve stem 63 to move downwardly. In turn, this causes the actuator 61 to slide axially downwards and compress the spring. The flange 68 of the actuator 61 is thus moved out of contact with the airflow holes 60 allowing the passage of air from an exterior of the device through the upper section 65 between the pressurised dispensing container 30 and walls, through the airflow holes 60, lower section 66 and aperture 67 into spacer chamber 11a. The airflow is then constrained to move with a cyclonic action as described in the first embodiment.

Further depression of the dispensing container 30 causes the lower end of the actuator 61 to come into contact with the base of the cylindrical housing at which point further axial movement of the actuator 61 is prevented. Thus, the valve stem 63 is depressed inwardly relative to the metering valve of the pressurised dispensing container 30 and a dose of product is discharged as a fine aerosol mist which is then entrained in the airflow.

The cyclonic flow of the entrained aerosol acts to classify the aerosol in a similar manner to the classification of the powdered medicament in the first embodiment. Larger aerosol droplets are held in the periphery of the spacer chamber 11a and only the relatively smaller aerosol droplets are drawn to the centre 18 and exit through aperture 16 for inhalation. This has the beneficial effect that smaller aerosol droplets are able to be inhaled deeper into the lungs than larger droplets. This has been found to have beneficial medical results, especially for medicaments for treating respiratory disorders such as asthma. The cyclonic nature of the flow also results in the flow path length of the aerosol being greatly increased when compared to a linear spacer. The airflow and entrained aerosol pass round the spacer chamber 11a many times before exiting through aperture 16. This provides a greatly increased time for the speed and inertia of the aerosol droplets to decrease before they are delivered to the user. As a result there is a greatly reduced risk of the aerosol droplets forcibly impacting on the oro-pharynx region of the throat of the user with its associated discomfort and potential damage.

It should be noted that this embodiment is suitable for use with many types of dispensing unit in which actuation of the pressurised dispensing container is co-ordinated with the inhalation cycle of the user and is not restricted to the particular device herein described.

Figure 9 shows a third embodiment of dispensing apparatus according to the present invention. The dispensing unit 30 and spacer unit 10 are the same as those described in the second embodiment. However, in addition, the dispensing apparatus 1 is provided with

a counter module 50 comprising a dose counting mechanism linked to the dispensing unit 30. A counter window 51 is provided viewable from an exterior of the housing 11 through which is displayed in use a counter indication 52 indicating either the number of doses dispensed or the number of doses remaining to be dispensed. The counter module is linked to the dispensing unit 30 such that each actuation of the dispensing unit actuates the counter module to either increment or decrement the counter indication as appropriate.

Figures 10 and 11 show a fourth embodiment of dispensing apparatus according to the present invention. The dispensing unit 30 is a pressurised dispensing container and is identical to that described in the second embodiment. The spacer unit 10 is also the same as that described in the second embodiment. The difference with the third embodiment lies in the means of actuating the pressurised dispensing container 30.

As in the third embodiment, the cylindrical housing 36 is divided into upper and lower sections 65 and 66 by a partition having airflow holes 60.

The valve stem 63 of the pressurised dispensing container 30 is received sealingly in a tubular actuator 80 which defines an annular shoulder which acts as stop limiting the extent to which the valve stem 63 extends within the actuator 80.

The actuator 80 is received as a snug fit within a downwardly extending tubular projection 81 formed integrally with the cylindrical housing 36. The tubular projection 81 has a lower end wall 94 defining an aperture 95 communicating with an annular space 96 formed between the lower end wall and the actuator 80. A nozzle 97 defined by the tubular projection 81

communicates with the annular space 96 and is orientated to release product from the annular space into the lower section 66 in the direction of the aperture 67 into the spacer chamber 11a.

A secondary valve means is formed in the tubular projection 81 by an annular valve seat 99 at the lower end of the actuator 80 and a resilient valve member 90 which extends from the lower section 66 into the annular space 96 and is normally urged into sealing contact with the valve seat 99 by a spigot 91. The valve member 90 has a cylindrical body which is recessed to accommodate the spigot 91 as an interference fit so that the spigot and valve member are sufficiently firmly connected to enable the valve member to be positively unseated from the valve seat when the spigot is retracted. the valve member is a sliding fit within the aperture 95 and is provided with a radially projecting flange 107 of greater diameter than the aperture 95 so that the flange acts as a stop limiting downward motion of the valve member 90 through the aperture.

The actuator 80 is provided with a radially extending flange 82 of external diameter slightly less than the internal diameter of the cylindrical housing 36 such that a restricted annular air passageway is defined between the flange 82 and the housing 36.

The actuator 80 and the hollow tubular valve stem together define a first chamber which is normally closed at its upper end by the internal valve means of the pressurised dispensing container and at its lower end by the secondary valve means.

In use, a user depresses the pressurised dispensing container 30 relative to the housing 36 so as to actuate the pressurised dispensing container 30 by relative movement between the container and the

valve stem 63 which is prevented from downward movement by abutment with the annular shoulder in the actuator 80.

Actuation of the pressurised dispensing container 30 results in a pressurised metered dose of fluid entering the first chamber from which it is prevented from escaping by the secondary valve means. The user then inhales through the mouthpiece 12 thereby reducing air pressure within the spacer chamber 11a and the lower section 66 of the cylindrical housing 36. The annular flange 82 is subject to a downward force because of an imbalance of air pressure above and below the flange, since the air pressure above the flange is maintained at ambient air pressure by the airflow holes which are open to atmosphere. The flange 82 is thereby urged downwardly against the spring pressure provided by the spring. As the flange moves downwardly, the spigot 91 also moves downwardly thereby unseating the resilient valve member 90 from the valve seat 99 so that the pressurised fluid escapes from the first chamber into the annular space 96 which constitutes a second chamber. As fluid begins to escape, dissolved propellant in liquid form boils off from the dispensed dose causing the fluid to rapidly expand. This expansion assists in further displacing the valve member 90 away from the seat 99. Displacement of the valve member 90 away from the seat 99 is limited by engagement between the flange 107 and the lower end wall 94 of the tubular projection 81. The pressurised fluid in the second chamber, i.e. annular space 96, then escapes via the nozzle, and is drawn into the spacer chamber 11a.

The spacer chamber 11a imparts a cyclonic action to the dispensed product as described in the previous embodiments with the same beneficial results of

classification of the aerosol droplets and slowing of the droplets.

It should be noted that the dispensing apparatus 1 is suitable for use with other dispensing units which comprise means for actuating the pressurised dispensing container by the inhalation force produced by the user and is not restricted to the specific embodiment described herein.

A fifth embodiment of dispensing apparatus according to the present invention comprises the dispensing unit 30 and spacer unit 10 of the fourth embodiment. However, in addition, the dispensing apparatus 1 is provided with a counter module 50 as described in the third embodiment.

Claims:

1. Inhalation apparatus comprising a housing, defining therein a chamber having a major axis; an inlet communicating with the chamber and with a dispensing unit; and a mouthpiece communicating with the chamber through an aperture at or near the major axis; wherein when a user of the apparatus inhales through the mouthpiece an airflow is created from the inlet through the chamber to the mouthpiece such that product dispensed from the dispensing unit is directed into the chamber in a direction having a component tangential to the major axis such that the airflow in the chamber is directed in an inwardly rotational direction from the inlet to the aperture.

2. Inhalation apparatus as claimed in claim 1 wherein the chamber is cylindrical.

3. Inhalation as claimed in claim 1 or claim 2 wherein the inlet communicates with the chamber through an inlet duct orientated in a tangential direction.

4. Inhalation apparatus as claimed in any preceding claim wherein the aperture is formed at or near the centre on one side of the housing.

5. Inhalation apparatus as claimed in any preceding claim wherein the mouthpiece is perpendicular to the major axis of the chamber.

6. Inhalation apparatus as claimed in any preceding claim wherein the width of the chamber, as measured in the direction of the major axis, decreases from the

periphery of the chamber to the centre.

7. Inhalation apparatus as claimed in any preceding claim further comprising an integral secondary housing communicating with the inlet in which in use a dispensing unit is received.

8. Inhalation apparatus as claimed in claim 7 wherein the secondary housing comprises upper section separated by a partition from a lower section which communicates with the inlet, airflow holes being provided in the partition, the upper section defining a socket in which in use the dispensing unit is received and the lower section comprising actuation means for actuating the dispensing unit.

9. Inhalation apparatus as claimed in claim 8 wherein the actuation means is actuated by inhalation of the user on the mouthpiece.

10. Inhalation apparatus as claimed in claim 8 wherein the actuation of the actuation means is coordinated with inhalation of the user on the mouthpiece.

11. Inhalation apparatus as claimed in any preceding claim further comprising means for counting the number of actuations of the dispensing unit and displaying a visual indicator correlated to the number of actuations.

12. Inhalation apparatus as claimed in claim 11 wherein the visual indicator is a number indicating the number of actuations.

13. Inhalation apparatus as claimed in claim 11 wherein he visual indicator is a number indicating the number of actuations remaining before the dispensing apparatus is empty.

14. Inhalation apparatus as claimed in any preceding claim formed as a unitary moulding.

15. The inhalation apparatus of any of claims 1 to 14 connected to a dispensing unit.

16. Inhalation apparatus as claimed in claim 15 wherein the dispensing unit is removably connected.

17. Inhalation apparatus as claimed in claim 15 wherein the dispensing apparatus is fixedly connected.

18. Inhalation apparatus as claimed in any of claims 15 to 17 wherein the dispensing unit is a dry powder inhaler.

19. Inhalation apparatus as claimed in any of claims 15 to 17 wherein the dispensing unit is a pressurised dispensing container comprising a pressurised container and metering valve.

20. A method of inhaling product comprising providing a housing defining therein a chamber having an inlet communicating with the chamber and with a dispensing unit, and a mouthpiece communicating with the chamber through an aperture at or near a centre of the chamber; dispensing product from the dispensing unit; and inhaling on the mouthpiece to create an airflow from an exterior of the housing through the dispensing unit and chamber to the mouthpiece to entrain the

product therein; wherein the airflow in the chamber is directed in an inwardly rotational direction from the inlet to the aperture.

21. Inhalation apparatus substantially as hereinbefore described with reference toa nd as shown in the accompanying drawings.

Amendments to the claims have been filed as follows

CLAIMS:-

1. Inhalation apparatus comprising a housing defining a socket for receiving a pressurised dispensing container, actuator means for receiving a valve stem of the pressurised dispensing container and a cylindrical chamber having an inlet located at a periphery of the chamber and an outlet at or near a centre of the chamber, the actuator means defining duct means to direct product dispensed from the valve stem of the pressurised dispensing container through the inlet of the cylindrical chamber in a direction substantially tangential to the major axis of the cylindrical chamber, the outlet of the cylindrical chamber communicating with a mouthpiece, such that inhalation by a user on the mouthpiece creates a cyclonic airflow in the cylindrical chamber between the inlet and outlet in which the dispensed product is entrained for inhalation.

2. Inhalation apparatus as claimed in claim 1, wherein the width of the chamber, as measured in the direction of the cylindrical chamber's major axis, decreases from the periphery of the chamber to the centre.

3. Inhalation apparatus as claimed in claim 1 or claim 2, wherein an aperture is formed at or near the centre on one side of the cylindrical chamber.

4. Inhalation apparatus as claimed in any preceding claim, wherein the socket comprises an upper section separated by a partition from a lower section which communicates with the inlet to the cylindrical chamber, airflow holes being provided in the partition.

5. Inhalation apparatus as claimed in any preceding claim, wherein the actuator means is actuated by inhalation of the user on the mouthpiece.

6. Inhalation apparatus as claimed in any of claims 1 to 4, wherein the actuation of the actuator means is co-ordinated with inhalation of the user on the mouthpiece.

7. Inhalation apparatus as claimed in any preceding claim further comprising means for counting the number of actuations of the dispensing unit and displaying a visual indicator correlated to the number of actuations.

8. Inhalation apparatus as claimed in claim 7, wherein the visual indicator is a number indicating the number of actuations.

9. Inhalation apparatus as claimed in claim 7, wherein the visual indicator is a number indicating the number of actuations remaining before the pressurised dispensing container is empty.

10. Inhalation apparatus as claimed in any preceding claim formed as a unitary moulding.

11. A method of inhaling product dispensed from a pressurised dispensing container comprising the steps of inhaling on a mouthpiece of an inhalation apparatus comprising a cylindrical chamber having an inlet at a periphery thereof and an outlet at or near a centre thereof which communicates with the mouthpiece, to thereby create a cyclonic airflow from the inlet to the outlet, actuating the pressurised dispensing container to dispense a dose of product through the inlet of the cylindrical chamber in a direction

substantially tangential to the major axis of the cylindrical chamber such that the product is entrained in the airflow and inhaled through the mouthpiece.

12. A method as claimed in claim 11 wherein inhalation on the mouthpiece actuates the pressurised dispensing apparatus.

13. Inhalation apparatus substantially as hereinbefore described with reference to and as shown in the accompanying drawings.

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Application No:	GB 9827402.0	**Examiner:**	L.V.Thomas
Claims searched:	1-21	**Date of search:**	25 February 1999

Patents Act 1977
Search Report under Section 17

Databases searched:

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UK Cl (Ed.Q): A5T (TBD, TBE)

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Other: -

Documents considered to be relevant:

Category	Identity of document and relevant passage		Relevant to claims
X	WO 98/26827 A1	(INNOVATA BIOMED) see p.3 l.25 - p.4 l.9 and p.8 ll.13-30	1 at least
X	WO 90/15635 A1	(HUHTAMÄKI OY) see p.7 l.18 - p.8 l.7, p.11 l.13 - p.12 l.19, claim 1 & Figs.3 & 4	1 at least
X	WO 88/03419 A1 Spacer for MDI	(HUHTAMÄKI OY) see p.2 ll.3-19, p.3 ll.22-33, p.4 l.28 - p.5 l.14 and p.6 l.22 - p.7 l.18	1 at least
X	EP 0475257 A1	(CHIESI) see col.3 l.44 - col.4 l.6 and col.4 l.49 - col.5 l.29	1 at least
X	US 5309900	(KNOCH ET AL.) see col.3 ll.10-66	1 at least

X	Document indicating lack of novelty or inventive step	A	Document indicating technological background and/or state of the art.
Y	Document indicating lack of inventive step if combined with one or more other documents of same category.	P	Document published on or after the declared priority date but before the filing date of this invention.
&	Member of the same patent family	E	Patent document published on or after, but with priority date earlier than, the filing date of this application.